19. Obtain the Wave equation for the vibration of an infinite string.

20. State and Prove Reciprocity theorem.

APRIL/MAY 2025

23PPH11 — MATHEMATICAL PHYSICS

Time : Three hours Maximum : 75 marks

SECTION A — ($10 \times 2 = 20$ marks)

Answer ALL questions.

1. List out the properties of Linear Operations.

2. What is meant by the dual space in vector spaces?

3. When a function is said to be harmonic functions?

4. What is a singular point in complex analysis?

5. What is the rank of matrix?

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6. Find inverse of the matrix $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$

7. What is inverse Fourier transform?

8. What is the Laplace transform of a derivative?

9. Define the concept of a generating function.

10. What is the Rodrigue formula for Legendre polynomials?

SECTION B — (5 × 5 = 25 marks)

Answer ALL questions.

11. (a) How does the Gram-Schmidt process help in orthogonalizing a set of vectors?

Or

(b) Discuss the significance of eigenvalues and eigenfunctions in vector spaces.

12. (a) How are Taylor and Laurent series used in complex analysis?

Or

(b) Discuss the significance of zeros and poles in complex functions.

13. (a) How will you find the adjoint of a matrix.

Or

(b) Discuss the significance of eigenvalues and eigenvectors in matrix theory.

14. (a) How Laplace equation can be used in semi-infinite strip.

Or

(b) Analyze the role of the convolution theorem in Fourier analysis.

15. (a) How are Hermite polynomials used in solving differential equations?

Or

(b) Inspect the significance of Sturm - Liouville theory in mathematical physics.

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SECTION C — (3 × 10 = 30 marks)

Answer any THREE questions

16. Determine the importance of orthogonal transformations in physics.

17. State and prove Cauchy integral theorem.

18. Analyze the role of Hermitian and unitary matrices in quantum mechanics.